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APPLICATION FOR PATENT

of

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for

RESILIENT MAGNETIC PAINTBRUSH HOLDER

BACKGROUND OF THE INVENTION

Painters have found that a brush holder of some type is a very useful item. The brush holder avoids the need to lay a wet brush on a surface which may not be clean. Further, the holder keeps the brush from falling into the paint in the paint can, particularly if the brush is relatively small and the can is relatively full. Also, a brush holder serves to maintain the brush in a ready-to-use condition and at a consistent location.

Because of the usefulness of a brush holder, inventors have devised a large number of holders for supporting a paintbrush in a paint can. In one type of paintbrush holder, the holder includes a clamp that grasps the handle of the paintbrush. In another type of holder, a magnet is used to hold the paintbrush by magnetic attraction between the magnet and the ferrule of the paintbrush. The present invention is an improvement on the magnetic type of paintbrush holder.

In a typical magnetic paintbrush holder of the prior art, the magnet included a pole face that is located in a vertical plane or an inclined plane. The ferrule of the brush is drawn against the pole face by magnetic attraction, and this force is in a direction

perpendicular to the pole face. The friction between the ferrule and the pole face causes the existence of a force that opposes movement of the ferrule in any direction along the pole face. If the force of magnetic attraction is F, then the frictional force resisting motion parallel to the pole face is μF, where μ is the static coefficient of friction.

A second force at work is the weight W of the paintbrush. If the pole face is inclined with respect to the horizontal by an angle θ, the component of the weight of the paintbrush in a direction parallel to the pole face is $W \sin \theta$. In order for the paintbrush not to slide along the pole face, it is necessary for $W \sin \theta$ to be less than μ times F. That is,

$$W \sin \theta < \mu F$$

where W is the weight of the paintbrush, θ is the inclination of the pole face with respect to the horizontal, F is the force of magnetic attraction between the pole face and the ferrule and, μ is the coefficient of static friction. If the pole face lies in a vertical plane, this equation reduces to

$$F > \frac{W}{\mu}$$

From this it can be seen that if the coefficient of static friction is 0.2, and if the paintbrush weighs 1.0 pounds, then the magnetic force must exceed 5 pounds to prevent the paintbrush from sliding downward along the pole face.

If the magnetic force is only slightly greater than the force required to prevent the paintbrush from sliding when the paint can is stationary, problems will arise if the paint can is suddenly picked up or set down by the user. When the can is picked up, the "g-force" that we feel in an ascending elevator causes the brush to behave as if it were substantially heavier. This tends to cause the brush to slide downward along the pole face and into the paint. On the other hand, if the paint can is set down abruptly, the inertia of the paintbrush will again cause it to slide downwardly along the pole face and into the paint.

To make matters worse, for the great majority of materials, the coefficient of sliding friction is less than the coefficient of static friction. This means that once the brush starts to slip, the frictional force opposing its motion actually decreases, thereby locking it into a sliding mode.

One's initial impulse might be to make the magnet stronger. However, upon reflection this is seen to be a very limited solution. Typical magnetic forces are in the one-five pound range. Increasing the magnetic force beyond this level would require the painter to wrestle with the holder to free his paintbrush, and most painters will lose patience with this after a number of repetitions. Further, serious safety problems may result if the painter is working on a ladder or in some other awkward position.

In summary, existing magnetic paintbrush holders are susceptible to mechanical shocks and accelerations, which cause the brush to become dislodged and to fall into the paint.

SUMMARY OF THE INVENTION

As discussed above, a major shortcoming of existing magnetic paintbrush holders is their inability to withstand sudden mechanical shocks, which cause the paintbrush to become dislodged and to fall into the paint. Recognizing that making the magnet stronger renders the device impractical because of the difficulty in releasing the brush from the holder, the present inventor set out to solve the problem.

His main insight was in recognizing the need to mechanically isolate the paintbrush and magnet from the paint can.

His solution is to insert a resilient member between the magnet and the paint can. In one embodiment, the resilient member is a spring. In another embodiment, it is a length of a resilient material. In these embodiments, any mechanical shocks felt by the paint can are absorbed by the resilient member, and in this sense, it could be said that the invention lies in inserting a shock absorber between the magnet and the paint can. In general, the shock absorbing member may be part of a one-piece article that includes the clamp that is used for attaching the device to the paint can.

The novel features which are believed to be characteristic of the invention, both as to organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in

connection with the accompanying drawings in which several preferred embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view showing a first preferred embodiment of the resilient magnetic paintbrush holder of the present invention;

Fig. 2 is an exploded perspective view showing a second preferred embodiment of the present invention;

Fig. 3 is a diagram used for explaining the invention; and,

Fig. 4 is a diagram used for explaining the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows a first preferred embodiment of the present invention. In that embodiment, a spring 2 connects the clamp 6 with a magnet 1. In this embodiment, caps 3 are secured to both ends of the spring 2. One of the caps is bonded to the magnet 1 by the use of an epoxy adhesive, and the other cap is bonded to the channel 4 portion of the clamp 6. The clamp includes a thumb screw 5 that is used for securing the clamp to the rim of an open paint can.

Fig. 2 is an exploded perspective view showing a second preferred embodiment of the invention. In this embodiment, the clamp 6 (except for the thumb screw 5) the resilient member 7, and the magnet holder 8 are fabricated by a molding process and constitute a one-piece structure. The magnet 1 is bonded into the magnet holder 8, and the thumb screw 5 is added. The clamp 6 fits over the rim of the paint can and is secured in place by tightening the thumb screw 5.

In both embodiments, the thumb screw clamp 6 may be replaced by a resilient clamp without departing from the spirit of the invention.

Figs. 3 and 4 are diagrams used for explaining the invention. In Fig. 3, the pole face of the magnet 1 is shown as being inclined at an angle θ with respect to the horizontal. The magnetic attraction force is denoted by F, and is perpendicular to the pole face. The weight W of the paintbrush is vertically downward and its component parallel to the pole face is $W \sin \theta$. The frictional force always opposes motion and its magnitude is μF where μ is the static coefficient of friction.

In order for the paintbrush not to slide down the pole face, it is necessary for the frictional force μF to be greater than the downward component of the weight, namely $W \sin \theta$. If the pole face is vertical, $\sin \theta$ equals 1.0 and the weight of the paintbrush must be less than μF.

The coefficient of static friction depends on the specific materials involved; for metals it might be on the order of 0.2. This would imply that a magnetic attraction force of 5 pounds would result in a frictional force of only 1 pound.

Turning now to Fig. 4, the paintbrush 9 and magnet 1 located at the end of the resilient portion 7 will vibrate up and down as indicated by the arrows, when set into motion. One way to set the brush into vibratory motion is for the user to set the paint can down abruptly onto a hard surface.

Thus, it is recognized that the system comprised of the paintbrush and resilient portion constitutes a classical physics situation of a mass mounted on a spring; such systems have been thoroughly studied. The time required for one complete cycle of the vibration is

$$T = 2\pi \sqrt{\frac{M}{K}}$$

where

T is the time in seconds for one complete cycle of vibration,

π is 3.1416

M is the mass in pound second squared per foot, found by dividing the weight W of the magnet and paintbrush in pounds by the gravitational

acceleration of 32 feet per second squared,

and K is the force constant of the resilient member in pounds per foot, determined experimentally by observing the deflection that results when the resilient member is loaded with a known weight.

For example, if the paintbrush weighs 0.5 pound and it requires 3 pounds to produce a deflection of one inch, then the time required for one complete cycle of the vibration is 0.1307 seconds; the frequency of the vibration is 7.65 cycles per second.

The maximum displacement of the brush occurs at the end of the first quarter cycle after the paint can is set down. In the example, that is 0.0327 seconds after the can is set down. At that time, the instantaneous velocity is zero; but because the elastic restoring force is greatest, the acceleration is also greatest. The acceleration at maximum displacement can be calculated by the equation

$$a = \frac{K}{M} D$$

where a is the maximum acceleration and D is the maximum displacement. That is, the acceleration depends on how hard the paint can was set down. To find the maximum deflection, consider that the paintbrush continues it's downward motion against the restoring force of the resilient member until all of the initial kinetic energy of the brush and magnet $\frac{1}{2}M V_0^2$ has been converted into potential energy stored in the resilient member, where V_0 is the velocity of the paintbrush as the paint bucket is being set down. This potential energy (P.E.) may be calculated by the equation

$$P.E. = \frac{1}{2} K D^2$$

Equating the initial kinetic energy to the potential energy at the maximum displacement gives the equation

$$\frac{1}{2} M V_0^2 = \frac{1}{2} K D^2$$

from which D can be calculated as

$$D = V_0 \sqrt{\frac{M}{K}}$$